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Genomic Study Points to Natural Origin of COVID-19 – NIH Director's Blog

# NIH Director's Blog

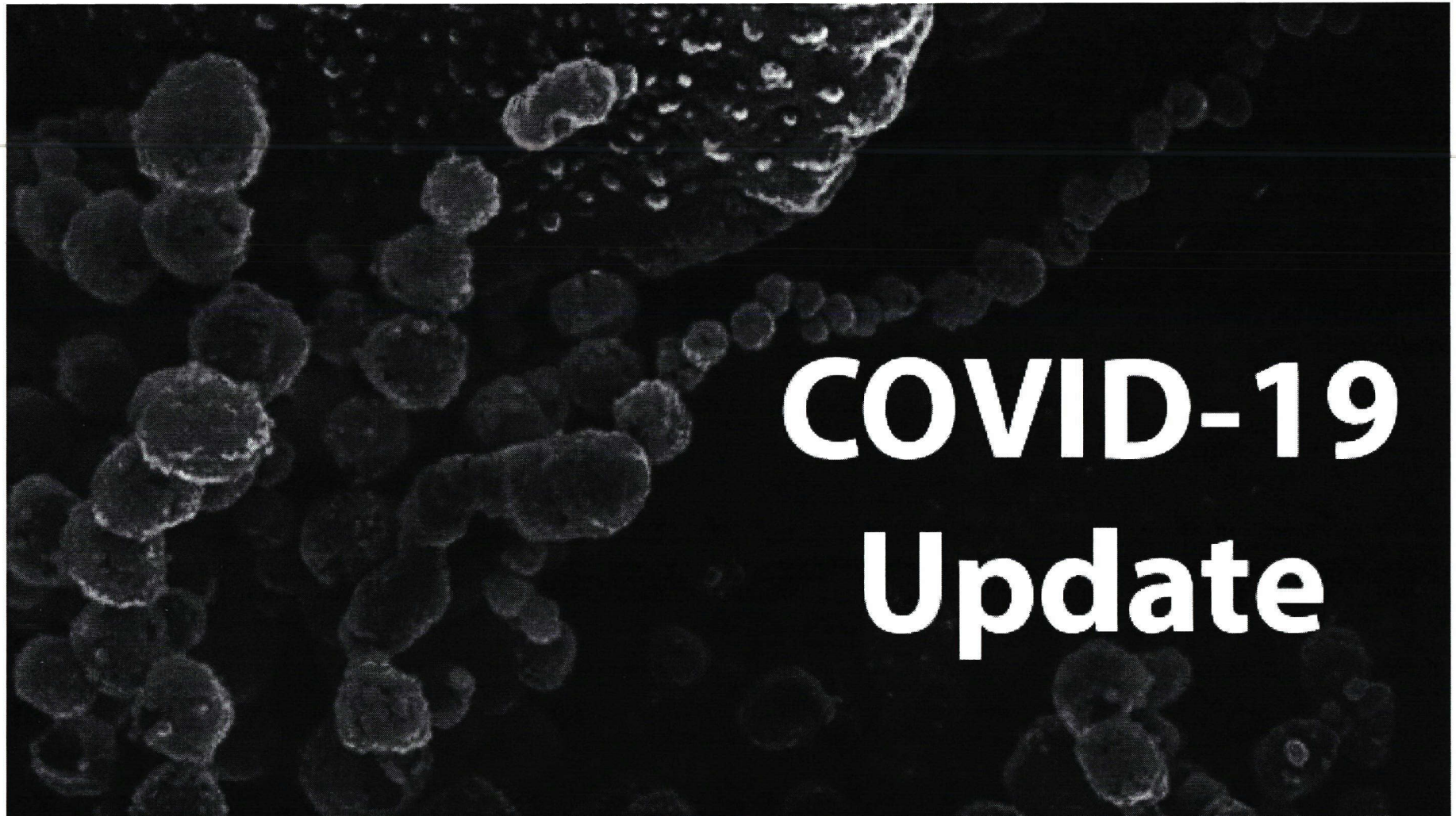
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## Genomic Study Points to Natural Origin of COVID-19

Posted on March 26th, 2020 by Dr. Francis Collins





No matter where you go online these days, there's bound to be discussion of coronavirus disease 2019 (COVID-19). Some folks are even making outrageous claims that the new coronavirus causing the pandemic was engineered in a lab and deliberately released to make people sick. A new study debunks such claims by providing scientific evidence that this novel coronavirus arose naturally.

The reassuring findings are the result of genomic analyses conducted by an international research team, partly supported by NIH. In their study in the journal *Nature Medicine*, Kristian Andersen, Scripps Research Institute, La Jolla, CA; Robert Garry, Tulane University School of Medicine, New Orleans; and their colleagues used sophisticated bioinformatic tools to compare publicly available genomic data from several coronaviruses, including the new one that causes COVID-19.

The researchers began by homing in on the parts of the coronavirus genomes that encode the spike proteins that give this family of viruses their distinctive crown-like appearance. (By the way, "corona" is Latin for "crown.") All coronaviruses rely on spike proteins to infect other cells. But, over time, each coronavirus has fashioned these proteins a little differently, and the evolutionary clues about these modifications are spelled out in their genomes.

The genomic data of the new coronavirus responsible for COVID-19 show that its spike protein contains some unique adaptations. One of these adaptations provides special ability of this coronavirus to bind to a specific protein on human cells called angiotensin converting enzyme (ACE2). A related coronavirus that causes severe acute respiratory syndrome (SARS) in humans also seeks out ACE2.

Existing computer models predicted that the new coronavirus would not bind to ACE2 as well as the SARS virus. However, to their surprise, the researchers found that the spike protein of the new coronavirus actually bound far better than computer predictions, likely because of natural selection on ACE2 that enabled the virus to take advantage of a previously unidentified alternate binding site. Researchers said this provides strong evidence that that new virus was not the product of purposeful manipulation in a lab. In fact, any bioengineer trying to design a coronavirus that threatened human health probably would never have chosen this particular conformation for a spike protein.

The researchers went on to analyze genomic data related to the overall molecular structure, or backbone, of the new coronavirus. Their analysis showed that the backbone of the new coronavirus's genome most closely resembles that of a bat coronavirus discovered after the COVID-19 pandemic began. However, the region that binds ACE2 resembles a novel virus found in pangolins, a strange-looking animal sometimes called a scaly anteater. This provides additional evidence that the coronavirus that causes COVID-19 almost certainly originated in nature. If the new coronavirus had been manufactured in a lab, scientists most likely would have used the backbones of coronaviruses already known to cause serious diseases in humans.

So, what is the natural origin of the novel coronavirus responsible for the COVID-19 pandemic? The researchers don't yet have a precise answer. But they do offer two possible scenarios.

In the first scenario, as the new coronavirus evolved in its natural hosts, possibly bats or pangolins, its spike proteins mutated to bind to molecules similar in structure to the human ACE2 protein, thereby enabling it to infect human cells. This scenario seems to fit other recent outbreaks of coronavirus-caused disease in humans, such as SARS, which arose from cat-like civets; and Middle East respiratory syndrome (MERS), which arose from camels.

The second scenario is that the new coronavirus crossed from animals into humans before it became capable of causing human disease. Then, as a result of gradual evolutionary changes over years or perhaps decades, the virus eventually gained the ability to spread from human-to-human and cause serious, often life-threatening disease.

Either way, this study leaves little room to refute a natural origin for COVID-19. And that's a good thing because it helps us keep focused on what really matters: observing good hygiene, practicing social distancing, and supporting the efforts of all the dedicated health-care professionals and researchers who are working so hard to address this major public health challenge.

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Finally, next time you come across something about COVID-19 online that disturbs or puzzles you, I suggest going to FEMA's new Coronavirus Rumor Control web site. It may not have all the answers to your questions, but it's definitely a step in the right direction in helping to distinguish rumors from facts.

#### Reference:

[1] The proximal origin of SARS-CoV-2  Andersen KG, Rambaut A, Lipkin WI, Holmes EC, Garry RF. Nat Med, 17 March 2020. [Epub ahead of publication]

#### Links:

Coronavirus (COVID-19) (NIH)

COVID-19, MERS & SARS (National Institute of Allergy and Infectious Diseases/NIH)


Andersen Lab  (Scripps Research Institute, La Jolla, CA)

Robert Garry  (Tulane University School of Medicine, New Orleans)

Coronavirus Rumor Control (FEMA)

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- *springm* says:

June 29, 2020 at 8:36 am

I appreciate this blog your blog very helps full for me i really enjoyed this stuff dude. This is a very informative content...

Thank you for posting such a great article.

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- *arpi33* says:

July 3, 2020 at 7:00 am

A bunch of thanks for sharing your experience & knowledge with us ...

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- *Raven H. says:*

September 19, 2020 at 10:36 pm

Thanks, Francis, for this very informative article/blog. Coming from you, I know I can trust it. Fascinating, too, the more detailed aspects of the virus's development, and the helpful inclusion of a rumor-mill squelching website.

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- *Matt says:*

November 2, 2020 at 1:48 pm

Why could the virus not have come from a natural source, have been studied in a lab, and accidentally released into the wild. Not as a chemical weapon but as a blunder by a lab which had already previously violated security concerns?

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- *Dr. Navin Tiwari says:*

January 1, 2021 at 3:41 am

nice blog on origin of covid 19.

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- *Ma Thi Trang says:*

March 4, 2021 at 10:28 pm

Thanks, Francis, for this very informative article. Coming from you, I know I can trust it. Fascinating, too, the more detailed aspects of the virus's development, and the helpful inclusion of a rumor-mill squelching website.

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- *Paul Yang says:*

April 4, 2021 at 3:33 am

It's very useful. Thanks.

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- *M. says:*

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April 27, 2021 at 3:08 am

Thank you for sharing this information about covid 19.

Reply

- *Samit chatterjee* says:

May 14, 2021 at 2:13 pm

Great content . . .

Reply

- *Charlene Gubinczki* says:

August 19, 2021 at 11:36 am

Thanks for sharing. Knowledge is good!

Reply

- *Anna Brown Simon* says:

January 24, 2022 at 10:11 pm

hopefully one day the truth will be known: /

Reply

- *DR. SAUMYA PANDEY, PH.D.* says:

January 28, 2022 at 2:16 am

Enlightening update regarding Covid-19 and ACE-2 genomic intersections in differential susceptibility trends globally! Toll-like Receptors mediated clinicopathological sequale in Covid-19 variants Delta vs Omicron may be further investigated by amalgamating genomic data-sets with sophisticated algorithms for eventual design of predictive biomarkers in risk-stratification.

Reply

- *Connie C Williamson* says:

November 2, 2022 at 5:49 pm

THE TRUTH ABOUT THE NUMBER OF DEATHS RELATED TO THE VACCINE, ALONG WITH THE ADVERSE AFFECTS THAT IT HAS CAUSED, HOW THE VACCINE AFFECTS THE BODY, IF YOU WANT PEOPLES TRUST, YOU HAVE TOO EARN IT, OR EARN IT BACK. TOO MANY UN-ANSWERED QUESTIONS.

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